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A new species of *Euscorpius* Thorell, 1876 (Scorpiones, Euscorpiidae) from Marmara Region of Turkey

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Abstract

A new species of the genus *Euscorpius* Thorell, 1876 is described based on specimens collected from Bursa Province, in Marmara Region of Turkey. It is characterized by a mesotrichous trichobothrial pattern (*Pv*= 8, *et*= 6, *em*=4, *eb*= 4), medium size and light coloration. *Euscorpius* (*Euscorpius*) *rahsenae* **sp. n.** is the second species of the subgenus *Euscorpius* recognized in Turkey.

Keywords

Scorpion, *Euscorpius*, new species, Turkey

Introduction

The genus *Euscorpius* Thorell, 1876 is one of the most studied taxa of scorpions, however, because of its complexity, its taxonomy continuously changes and is not completely clear, especially in the Balkans, Turkey and in Western Europe. The *Euscorpius* populations of Turkey have been poorly studied, and only three valid species are recognized: *E.* (*Polytrichobothrius*) *italicus* (Herbst, 1800), *E.* (*Alpiscorpius*) *mingrelicus* (Kessler, 1874) and *E.* (*Euscorpius*) *avcii* Tropea et al., 2012. *E. mingrelicus*, which is a spe-

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cies complex has six described subspecies in Turkey [*E. m. mingrelicus* (Kessler, 1874), *E. m. ciliciensis* Birula, 1898, *E. m. phrygius* Bonacina, 1980, *E. m. ollivieri* Lacroix, 1995, *E. m. legrandi* Lacroix, 1995, and *E. m. uludagensis* Lacroix, 1995)] that need clarification.

Presence of the subgenus *Euscorpius* in Turkey have been reported many times, under the name of *E. carpathicus* or *E. carpathicus* "complex" from İstanbul (Hadži 1930); Havza (Samsun) (Schenkel 1947); Acıpayam and Honaz Mountain (Denizli), Eğridir (Isparta), Korikos (Mersin) and İstanbul (Vachon 1951); Sinop (Tolunay 1959); Amasya, the Middle Taurus, Borçka (Artvin), Çanakkale, Trakya and Efes (İzmir) (Kinzelbach 1975, 1982); Alanya (Antalya), Bursa Town and Gemlik (Bursa), Ayvacık and Çan (Çanakkale), Sarıyer, Üsküdar and Büyükada Island (İstanbul), Urla (İzmir), Fethiye (Muğla), Sinop Town and Ada vicinity (Sinop) (Karataş 2006); and Dilek Peninsula (Aydın) (Koç and Yağmur 2007). Furthermore, Kinzelbach (1975) recorded *E. mesotrichus* from Şile (İstanbul) and Prinkipos Island (Büyükada Island) in the Marmara Sea. Further studies (Di Caporiacco 1950; Fet 1997; Fet and Braunwalder 2000; Gantenbein et al. 2001; Fet and Soleglad 2002; Fet et al. 2003; Tropea et al. 2012; Tropea and Rossi 2011, 2012) reported that *E. mesotrichus* is not an available name, and populations within Kinzelbach's interpretation, referred to other species such as *E. tergestinus*, *E. balearicus, E. sicanus* and other forms. Recently, Tropea et al. (2012) described *E. avcii*, the first valid species of the subgenus *Euscorpius* in Turkey from Dilek Peninsula.

The new species described herein, *Euscorpius* (*Euscorpius*) *rahsenae* sp. n. is the second species of the subgenus *Euscorpius* s.str. in Turkey.

Materials and methods

A total of 59 specimens belonging to the new species were collected from Bursa Province, in the Marmara region of Turkey. Comparison material: *E. avcii*, holotype ♂, Dilek Peninsula National Park, Canyon, Dilek Peninsula, near Davutlar Town, Kuşadası, Aydın, Turkey, 07.10.2005, leg. H. Koç (MTAS); paratypes, 1 ♂, 5 ♀♀, Dilek Peninsula National Park, Canyon, Dilek Peninsula, near Davutlar Town, Kuşadası District, Aydın Province, Turkey, 07.10.2005, leg. H. Koç (MZUF); same data, 1 ♂, 2 ♀♀ (GTC); Abbreviations: *V*: trichobothria on ventral pedipalp chela manus; *Pv*: trichobothria on patella ventral surface; *Pe*: trichobothria on the pedipalp patella external surface; *et*: external terminal; *est*: external subterminal; *em*: external medium; *esb*: external suprabasal; *eba*: external basal *a*; *eb*: external basal; DPS: dorsal patellar spur; DD: distal denticle; MD: median denticles; OD: outer denticles; ID: inner denticles; IAD: inner accessory denticles; MZUF: Museo Zoologico 'La Specola' dell'Università di Firenze, Florence, Italy; GTC: private collection of Gioele Tropea, Rome, Italy; MTAS: Museum of the Turkish Arachnological Society; MSNB: Museo Civico di Scienze Naturali "E. Caffi", Bergamo, Italy; ZMSU: Zoology Museum of Sinop University, Turkey; KUAM: Arachnological Museum of Kırıkkale University,

Turkey; AZM: Alaşehir Zoological Museum, Celal Bayar University, Manisa, Turkey; FKCP: František Kovařík Collection, Praha, Czech Republic.

The trichobothrial notations follow Vachon (1974). The morphological measurements are given in millimeters (mm) following Stahnke (1970). The morphological nomenclature follows Stahnke (1970), Hjelle (1990) and Sissom (1990); the chela carinae and denticle configuration follows Soleglad and Sissom (2001) and sternum terminology follows Soleglad and Fet (2003); description and terminology of hemispermatophore follows Soleglad and Sissom (2001) and Fet and Soleglad (2002).

Taxonomy

Family Euscorpiidae Laurie, 1896
Genus *Euscorpius* Thorell, 1876
Subgenus *Euscorpius* Thorell, 1876

***Euscorpius rahsenae* Yağmur & Tropea, sp. n.**
urn:lsid:zoobank.org:act:9D78689F-F701-4CD5-9B79-A58BA80D88A4
http://species-id.net/wiki/Euscorpius_rahsenae

Type material. Holotype: 1♂, Tirilye Village, Mudanya District, Bursa Province, Turkey, 06.07.2012, 40°23'08.9"N, 28°48'20.9"E, 39 m, Red Pine Forest, leg. R.S. Kaya & H. Koru (AZM).

Paratypes: 1. 1♀. Beşevler Neighborhood, Nilüfer District, Bursa Province, 23.06.2004, 21.04.2012, 40°12'46"N, 28°57'58"E, 140 m, leg. R.S. Kaya (AZM). **2.** 1♀. Beşevler Neighborhood, Nilüfer District, Bursa Province, 05.05.2005, 40°11'47"N, 28°57'58"E, 153 m, leg. R.S. Kaya (AZM). **3.** 3♀♀. Yalıçiftlik Village, Ruined Building, Mudanya District, Bursa Province, 21.04.2012, 40°21'16"N, 28°42'58"E, 97 m, leg. H. Koru (AZM). Same data,1♂, 23.10.2012. **4.** 1♂, 1♀. Tirilye Village, Mudanya District, Bursa Province, 17.06.2012, 40°23'08.9"N, 28°48'20.9"E, 39 m, leg. E.A. Yağmur & R.S. Kaya (GTC). Same data, 6♀♀ (AZM). Same locality 4♂♂, 3♀♀, 06.07.2012, leg. R.S. Kaya & H. Koru; 3♂♂, 7♀♀, 22.09.2012, leg. R.S. Kaya & H. Koru (GTC). Same data 1♂, 1♀ (MSNB). Same data 2♂♂, 9♀♀ (AZM). Same locality 2♂♂, 8♀♀, 06.11.2012, leg. R.S. Kaya & H. Koru (AZM), 1♂, 1♀ (FKCP). **5.** 1♂, 1♀. Çiftehavuzlar Neighborhood, Karadeniz Street, Osmangazi District, Bursa Province, 28.10.2012, 40°12'30"N, 29°03'05"E, 110 m, Home garden, leg. H. Koru (AZM).

Etymology. The specific epithet refers to Dr. Rahşen S. Kaya, a Turkish arachnologist, for her friendship and kind contributions to collecting scorpions.

Diagnosis. A medium *Euscorpius* species, total length 27–34 mm. Color of adults very light brown-yellowish with carapace and pedipalps little darker, legs, telson and chelicerae lighter. Carinae dark, distinctly brownish-blackish, especially on pedipalps. Dark lines in the external or distal part of the coxa and sternum. The number of tricho-

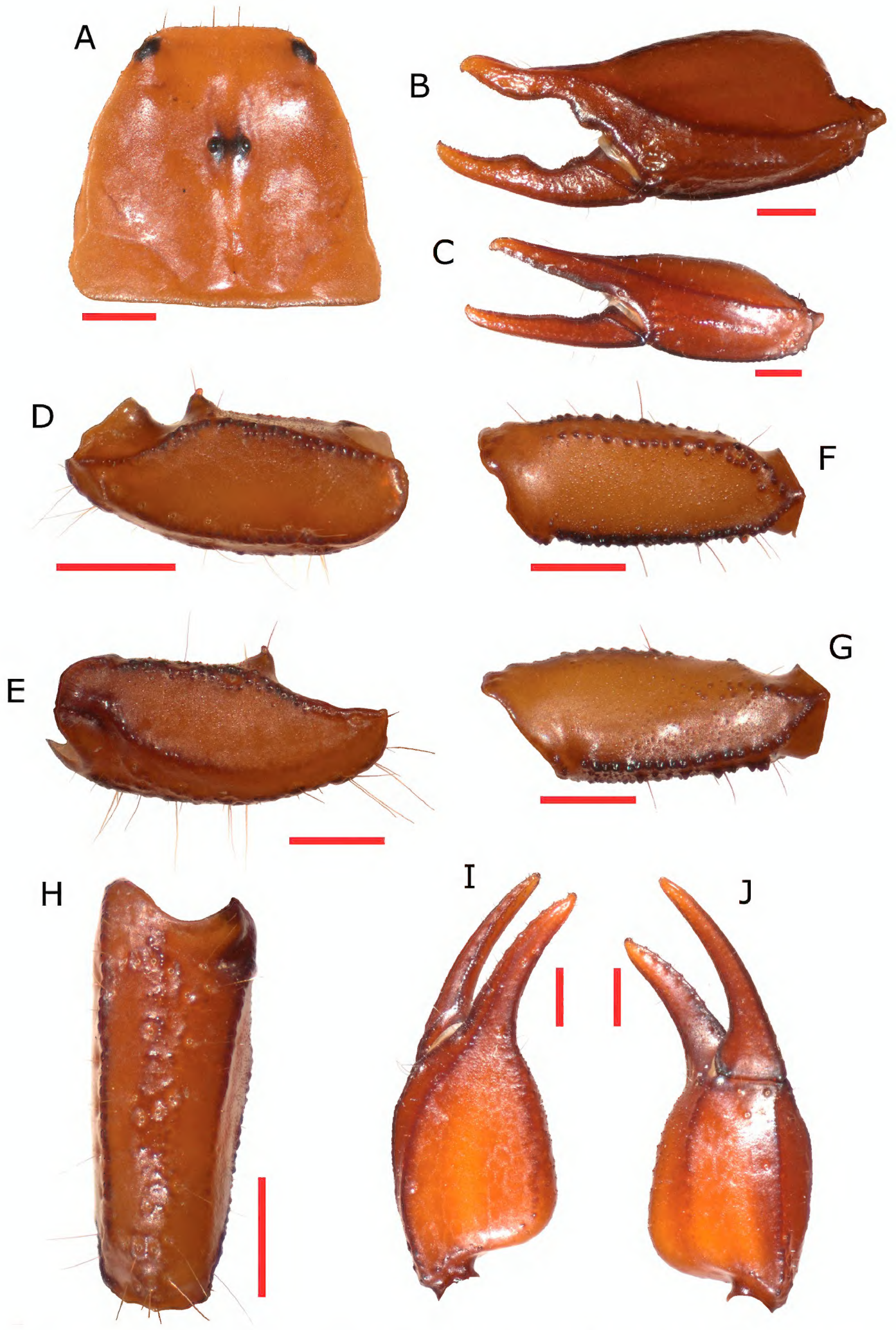

Figure 1. A carapace **B** external view of chela of the adult male **C** external view of chela of the adult female **D** ventral view of pedipalp patella **E** dorsal view of pedipalp patella **F** ventral view of pedipalp femur **G** dorsal view of pedipalp femur **H** view of external surface of pedipalp patella **I** dorsal view of chela **J** ventral view of chela.

bothria on the pedipalp manus ventral surface is 4 (3 *V* + *Et* 1); the number of trichobothria on the pedipalp patella ventral surface is 8 (in 87.29% of examined pedipalps); the number of trichobothria on pedipalp patella external surface is: *eb* = 4, *eba* = 4, *esb* = 2, *em* = 4, *est* = 4, *et* = 6 (in 77.96% of examined pedipalps). The pectinal teeth count is 9 (in 80.55% of examined pectines) in males, 7 (in 68.29% of examined pectines) in females. The telson vesicle in males is considerably more swollen than in females: average L/H ratio of the vesicle is 2.07 in male and 2.30 in females. Chela with a notch on fixed finger and scalloping of the movable finger in adult males, obsolete in females. Dorsal patellar spur well developed. Average L/W ratio of the chela is 2.35 in males and 2.48 in females. Average length/posterior width ratio of the carapace is 0.98. All carinae on pedipalps are strongly distinct and dark, in contrast with clear color of tegument. Average value of the length from center median eyes to anterior margin of the carapace is 42.47% of the carapace length. Average value of the length from center median eyes to posterior margin of the carapace is 57.53% of the carapace length.

Description of the holotype male. ***Coloration:*** Very light brownish with carapace and pedipalps little darker, legs, telson and chelicerae are lighter. The carinae are dark, distinctly brownish-blackish, especially on pedipalps. Dark lines in the external or distal part of the coxa and sternum. Granulometry on the femora of the legs, especially ventrally, dark. The sternites, pectines and genital operculum are very light brownish-white.

Carapace: Length 4.11 mm; posterior width 4.14. Very finely granulated. Distance from the center of the median eyes to the anterior margin of the carapace is equivalent to 42.33% of the prosoma; the length from the center of the median eyes to the posterior margin of the carapace is equivalent to 57.67% of the prosoma.

Mesosoma: Tergites very finely granulated; sternites finely punctate. The area of overlap between the sternites is lighter in color. Pectinal teeth count is 9-9. The spiracles are very small, oval-shaped and it is inclined about 45° downwards towards outside.

Metasoma: Medium size with respect to body length. Dorsal carinae from segment I-IV are granulated, exhibiting dark granules, obsolete on the segment V; ventromedian carinae from segment I-IV absent; ventromedian carinae on segment V are formed by fine granules; ventrolateral carinae on segment I absent, on segments II and III smooth, on segment IV is formed by small dark granules, on segment V is formed by dark granules; all intercarinal spaces are finely granulated.

Telson: Vesicle weakly swollen; smooth, with ventral setae of different sizes; telson height 1.38; telson length 3.75; vesicle length 2.85; vesicle width 1.38; L/H ratio of the vesicle 2.06.

Pectines: Pectinal teeth count 9-9; middle lamellae count 6-6.

Genital operculum: Partially divided with genital papillae protruding; a few microsetae present.

Sternum: Pentagonal shape, type 2. Length similar to width, deep posterior emargination.

Pedipalp: Coxa and trochanter with strong granulation. Femur: dorsal internal carinae tuberculate; dorsal external carinae formed by tubercles, slightly serrulated;

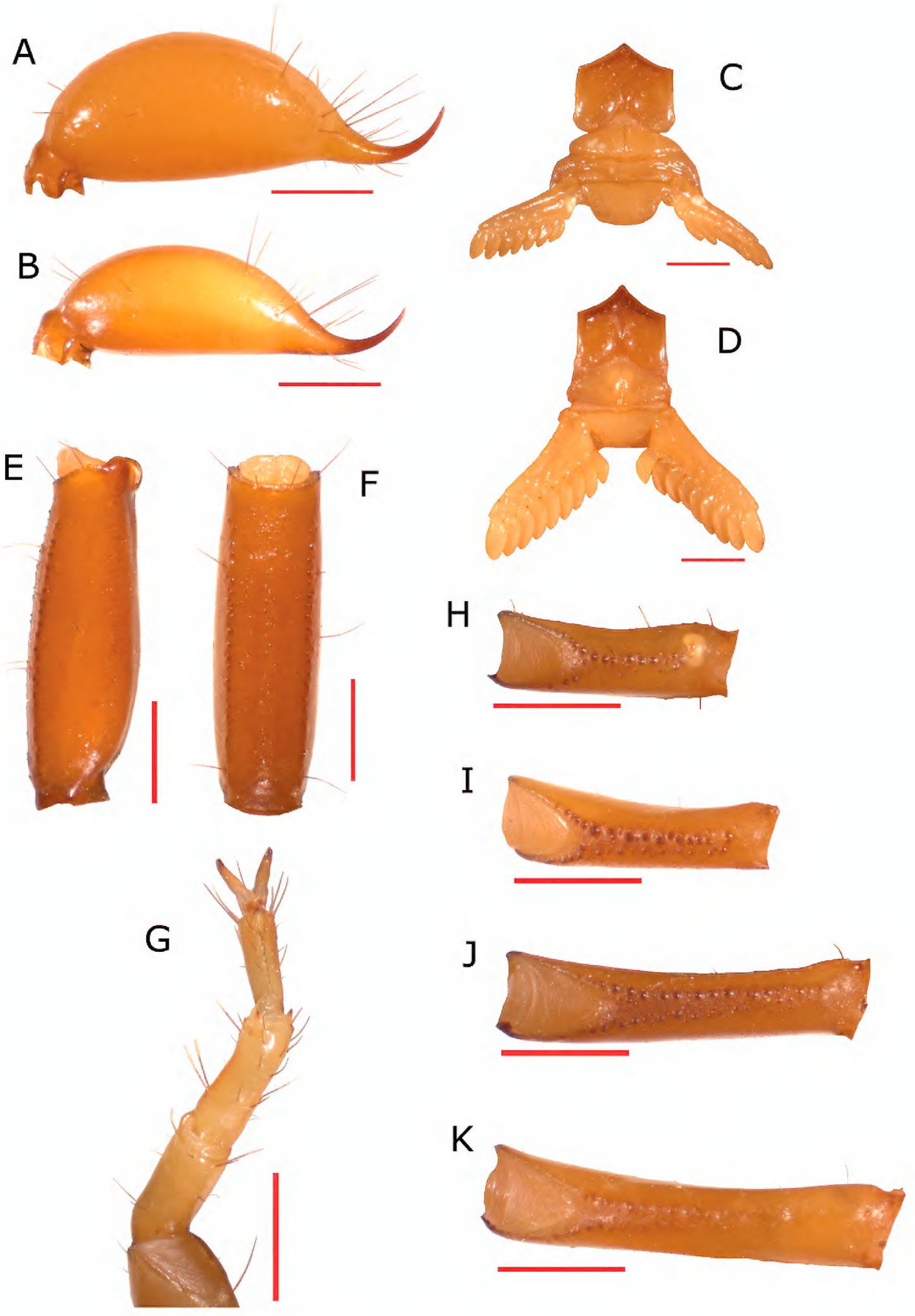

Figure 2. A telson of adult male **B** telson of adult female **C** sternopectinal area of adult female **D** sternopectinal area of adult male **E** latero-dorsal view of the metasomal segment V **F** ventral view of the metasomal segment V **G** tarsus and basitarsus **H** leg femur I **I** leg femur II **J** leg femur III **K** leg femur IV.

Figure 3. Dorsal and ventral views of *Euscorpius rahsenae* sp. n. male.

intercarinal spaces granulated; external median carinae serrulate, anterior median formed by hardly conical tubercle. Patella length 3.54; patella width 1.38; dorsal internal carinae crenulate to tuberculate; dorsal external carinae low, from rough to crenulate; Ventral external carinae crenulate; ventral internal carinae from serrulate to tuberculate; dorsal intercarinal tegument with granules of increased size from proximal to distal area; ventral intercarinal tegument from smooth to minutely granulate with a few bigger granules near to ventral internal carinae; internal intercarinal tegument uniformly finely granulate. Dorsal patellar spur averagely developed (Fig. 1E). Chelal carina D_1 is distinctly strong, dark and from smooth to rough; D_4 is rough with a few low granules in proximal area; V_1 is distinctly strong, from rough to crenulate and dark; V_3 dark on ¾ of length, mostly smooth with a few scattered minuscule granules; external carina rough and dark; intercarinal tegument from smooth to rough except between carinae D_4 and V_3, granulate. Movable finger dentition: MD form a straight line of very small denticles closely spaced with a DD on the distal tip; OD formed of 7 denticles on movable finger and 6 denticles on fixed finger, immediately outside of MD, their size increases progressively but the terminal denticle is not very pronounced; ID formed of 7 denticles on movable finger and 6 denticles on fixed fin-

Figure 4. Dorsal and ventral views of *Euscorpius rahsenae* sp. n. female.

Figure 5. Left hemispermatophore of *Euscorpius rahsenae* sp. n.

ger, spaced from MD, their size increases progressively but the terminal denticle is not very pronounced; IAD on both movable and fixed finger formed of 4 small denticles; L/W ratio of the chela 2.35

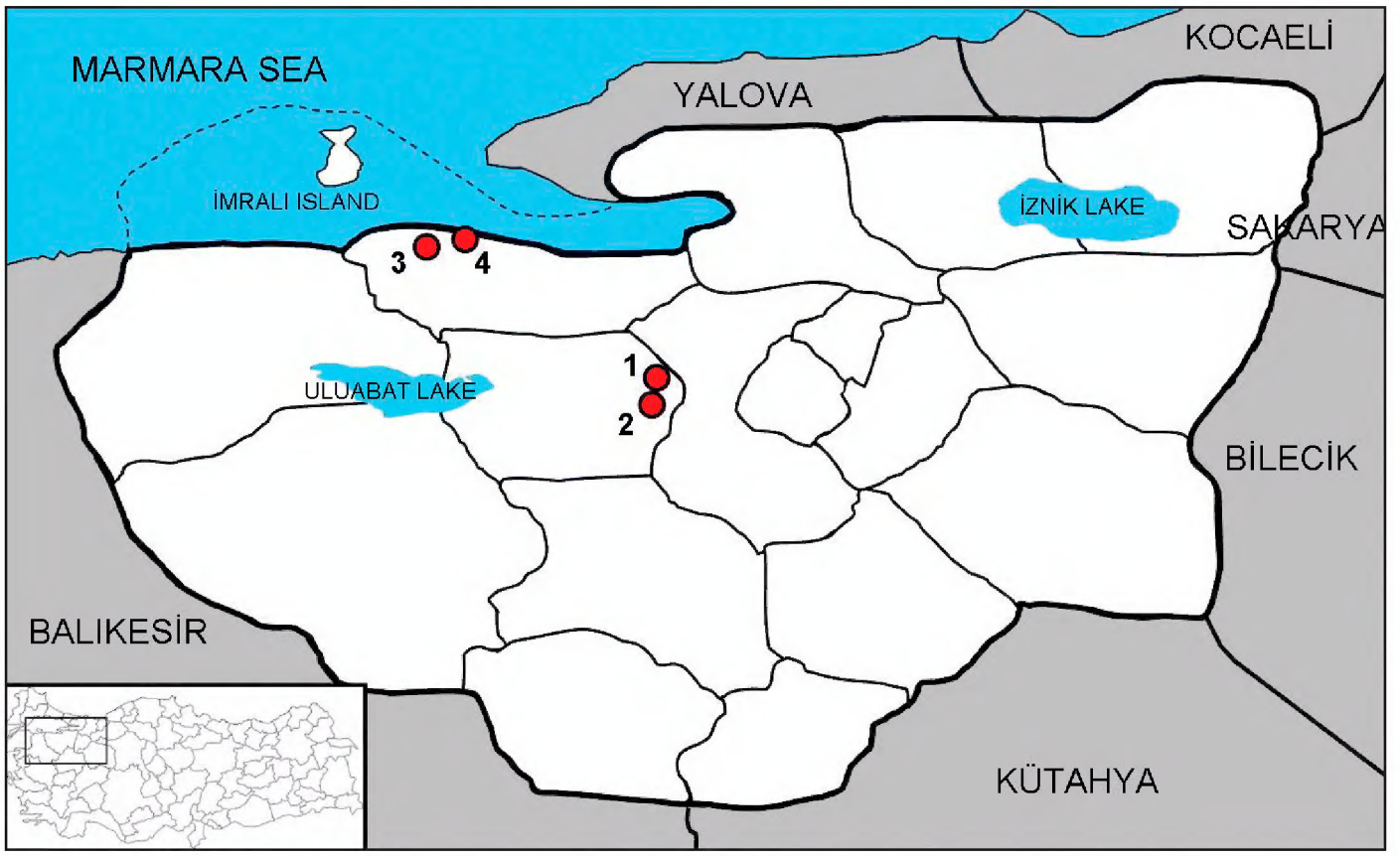

Figure 6. Sampling map of *Euscorpius rahsenae* sp. n. in Bursa Province

Figure 7. The pine forest habitat in Tirilye Village.

Trichobothria: Chela trichobothria series *V* standard: *V* = 4-4 (3 *V*+ *Et*1); patella ventral (*P*v): 8-8; Patella external (*P*e): *et* = 6-6, *est* = 4-4, *em* = 4-4, *esb* = 2-2, *eba* = 4-4, *eb* = 4-4.

Figure 8. The ruined building habitat in Yalıçiftlik Village.

Legs: legs with two pedal spurs. Tarsal ventral row with 10-12 stout spinules (including the ventral distal spinule pair); 3 flanking pairs of tarsal setae adjacent to the ventral spinules row. Basitarsus with 6-7 prolateral stout spinules on leg pair I; 4-3 prolateral stout spinules on leg pair II; absent on leg pair III and IV. Dark granulation present above leg femora, mostly ventrally; on the dorsal leg femora I it is weakly marked and of lighter color.

Chelicerae: smooth, without marbling, with darker teeth; the dorsal distal tooth is smaller than the ventral distal tooth; ventral edge is smooth with brush-like setae on the inner part; dorsal edge has five teeth: one distal, two small subdistal, one big median and a small basal; fixed finger has four teeth: one distal, one subdistal, one median and one basal; the median and the basal are in a fork arrangement; the internal edge has brush-like setae.

***Variation*:** The variation observed in 59 studied specimens (18 males, 41 females) as follows: pectinal teeth in males: 8-8 (2/18), 8-9 (1/18), 9-9 (13/18), 9-10 (2/18); females: 6-6 (1/41), 6-7 (3/41), 7-7 (23/41), 8-7 (7/41), 8-8 (6/41), 8-9 (1/41); pedipalp patella trichobothria *Pv*: 7-7 (2/59), 8-7 (10/59), 8-8 (46/59), 9-8 (1/59); pedipalp patella trichobothria *Pe*: *et* = 5-5 (6/59), 5-6 (14/59), 6-6 (39/59); *est* = 3-4 (2/59), 4-4 (57/59), *em* = 4-4 (59/59), *esb*= 2-2 (59/59), *eba* = 4-4 (59/59), eb = 4-4 (59/59). The variation in the trichobothrial pattern is within the standard values of variability and shows the stability of diagnostic characters.

Table 1. Measurements (in mm) of male holotype and female paratype of *Euscorpius rahsenae* sp. n.

		Holotype	Paratype female
Total	Length	28.86	28.21
Carapace	Length	4.11	4.06
	Posterior width	4.14	4.14
Metasoma	Length	11.40	10.34
Segment I	Length	1.50	1.32
	Width	1.49	1.38
Segment II	Length	1.80	1.62
	Width	1.26	1.13
Segment III	Length	1.98	1.85
	Width	1.20	1.08
Segment IV	Length	2.34	2.16
	Width	1.14	1.02
Segment V	Length	3.78	3.39
	Width	1.14	1.02
Telson	Length	3.75	3.30
Vesicle	Length	2.85	2.31
	Width	1.38	1.06
	Height	1.38	1.02
Aculeus	Length	0.90	0.99
Femur	Length	3.42	3.42
	Width	1.32	1.32
Patella	Length	3.54	3.53
	Width	1.38	1.44
Chela	Length	7.20	6.96
	Width	3.06	2.72
Movable finger	Length	4.20	3.90

Hemispermatophore: Well developed lamina with well visible basal constriction, tapered distally; truncal flexure present and well developed; capsular lobe complex well developed, with acuminate process; ental channel spinose distally, exhibiting 8-12 delicate spines.

Discussion and comparison

Karataş (2006) reported two assemblages of populations of the subgenus *Euscorpius* from Turkey as "*Euscorpius* sp.1" and "*Euscorpius* sp.2". The first has been reported from Bursa, Çanakkale, İstanbul, İzmir, and Sinop Provinces; the second has been reported from Antalya and Muğla Provinces. *E. rahsenae* sp. n. occurs within the area of the first assemblages (Marmara Region), however, in this work, we describe as *E. rahsenae* sp. n. only the population of particularly light specimens with a strong contrast

Table 2. Trichobothrial counts of *Euscorpius* species discussed in this paper.

Species	*Pv*	*Pe - et*	*Pe - est*	*Pe - em*	*Pe - esb*	*Pe - eba*	*Pe - eb*
E. rahsenae sp.n.	8	5-6 (6)	4	4	2	4	4
E. avcii	7	5-6 (5)	4	4	2	4	4
E. koschewnikowi	8	5-6	4	4	2	4	4
E. c. aegaeus	7-8 (8)	5-6 (6)	4	4	2	4	4
E. c. ossae	7	5	4	4	2	4	4
E. c. scaber	7-10(8/9)	6	4	4	2	4	4
E. c. candiota	9-10(10)	6-7(7)	4	4	2	4	4

of dark carinae, that occurs in the Bursa Province. We are conducting further studies to understand the relationship between *E. rahsenae* sp. n. and the reddish populations found further north.

Karataş (2006) compared "*Euscorpius* sp.1" with *E. koschewnikowi* from Greece, observing some differences; for this reason we also compared *E. rahsenae* sp. n. with *E. koschewnikowi*. Note that Karataş (2006), among the differences between "*Euscorpius* sp.1" and *E. koschewnikowi*, reported that in specimens studied by her, *V4* was situated on the *ventral* surface, internally from the exteroventral carina while according to Fet and Soleglad (2002) the trichobothrium *V4* is situated on the external surface, removed from the exteroventral carina in *E. koschewnikowi*. *E. rahsenae* sp. n. specimens, as well as those from İstanbul that coincide with "*Euscorpius* sp.1" of Karataş (2006), have the trichobothrium *V4* situated on the external surface, as is normal in the subgenus *Euscorpius*. It is possible that Karataş (2006) has misinterpreted the trichobothrial nomenclature of the chela.

E. koschewnikowi was described by Birula (1900) from Mt Athos, Agion Oros, in the northeast of Greece. Kinzelbach (1975) synonymized it with *E. carpathicus* but Fet and Soleglad (2002) redescribed this form, elevating it to species status. *E. koschewnikowi* is a medium to large sized species (up to 46 mm), medium to dark brown in color, slender appearance with well developed dorsal patellar spur and all metasoma segments longer than wide. In addition, according to Fet and Soleglad (2002) the exceptionally slender and smooth metasoma are key diagnostic characters of this species. *E. rahsenae* sp. n. differs by *E. koschewnikowi* for the colour very lighter, brownish-ivory, smaller average size, the metasomal segments not particularly smooth and the first segment not always longer than wide, especially in females (average L/W ratio 1.03 in males, 0.98 in females).

The only valid species belonging to the subgenus *Euscorpius* in Turkey is *E. avcii*. This species was recently described from Dilek Peninsula as an oligotrichous, small *Euscorpius*, with a length of 24-28 mm, light brown to brown-reddish colored with the carapace and pedipalps darker and legs and telson lighter (Tropea et al. 2012). It is possible to differentiate this species from *E. rahsenae* sp. n. as follows: the color of *E. avcii* is reddish brown while *E. rahsenae* sp. n. is very light brown-ivory with a strong contrast dark color of the carinae; *E. avcii* is on average smaller than *E. rahsenae* sp. n. (24–28 cm and 27–34 mm respectively); the pectinal teeth count in *E. avcii* is 7 in females and 8 in males while in *E. rahsenae* sp. n. is usually 7 in females and 9 in males;

Pv count is usually 7 in *E. avcii* and 8 in *E. rahsenae* sp. n.; *Pe-et* series is generally 5 in *E. avcii* and 6 in *E. rahsenae* sp. n.; hemispermatophore exhibiting 6 delicate spines in *E. avcii*, 8–12 in *E. rahsenae* sp. n.

The other forms of the subgenus *Euscorpius* are obviously different species and geographically distant. Below, we compare *E. rahsenae* sp. n. to some other forms present in the Aegean area: *E. sicanus* (C. L. Koch, 1837), *E. c. candiota* Birula, 1903, *E. c. scaber* Birula, 1900, *E. c. ossae* Di Caporiacco, 1950 and *E. c. aegaeus* Di Caporiacco, 1950.

E. sicanus complex is widespread in mainland Greece and some Aegean islands (Fet et al. 2003), and can be easily distinguished from *E. rahsenae* sp. n. by the trichobothrial series *eb* = 5 in *E. sicanus* complex and *eb* = 4 in *E. rahsenae* sp. n.

E. c. candiota is a light colored species, described from Crete. It can be distinguished by the *E. rahsenae* sp. n. by the higher number of trichobothria and pectinal teeth; *Pv* = 9/10 (usually 10), *Pe-et* = 6/8 (generally 7) and pectinal teeth count 9 to 10 in males (generally 10) and 7 to 8 in females, compared to *Pv* = 8, *Pe-et* = 6 and pectinal teeth count 9 in males and 7 in females.

E. c. scaber is a scorpion from the northern Aegean area, with a dark coloration, an higher number of pectinal teeth, an higher trichobothrial pattern, and in addition, a body totally covered by granules of various size, as also the name suggests, whereas *Euscorpius rahsenae* sp. n. is light yellowish-brown, without a particularly accentuated granulation. *E. c. ossae* is an oligotrichous form, dark brown in colour with lighter legs and telson. It was described from Mount Ossa, in Thessaly. This form can be distinguished mainly by the dark colour, the *Pv*=7 and *et*=5, compared with *Pv*=8 and Pe-*et*=6 of *E. rahsenae* sp. n. *E. c. aegaeus* is a light colored form described from the island of Antiparos, in the central-southern part of the Aegean Sea. Probably it is endemic in few islands in the central-south Aegean Sea. In addition, it is described as uniformly light yellow colored and females with pectinal teeth count 8 (Di Caporiacco 1950), while *E. rahsenae* sp. n. has carapace and pedipalps little darker, legs, telson and chelicerae lighter with carinae dark, distinctly brownish-blackish and pectinal teeth count 7 in females.

Ecology

Some specimens of *Euscorpius rahsenae* sp. n. were collected from city center (Beşevler and Çiftehavuzlar) and in a ruined building in Yalıçiftlik Village (Mudanya District) of Bursa Province. It shows that *Euscorpius rahsenae* sp. n. penetrates to human settlements and is an anthropotelerant species.

A large part of Mudanya is an urban area, but the Tirilye locality (Mudanya) has vegetation composed of red pine (*Pinus brutia* Ten.), torch pine (*Pinus nigra* Arn. subsp. *pallasiana* (Lamb)), olive trees (*Olea europea* L.), and maquis vegetation (*Quercus* sp., *Erica arborea* L., *Juniperus oxycedrus* L., *Phillyrea latifolia* L., *Pistacia lentiscus* L., *Cistus* spp., as main shrubs). The specimens were collected in this locality during night trips with UV light when sitting in cracks of the earthen wall along the roadsides in the forest.

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